wintershall dea

# RELINQUISHMENT REPORT

## PL927 Vikafjell

Sval

# PL927 Relinquishment Report

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## Summary


### Introduction

Following the APA 2017 application round, PL 927 was awarded 02.03.2018. Wintershall Dea Norge AS have been the operator for the licence along with partner Sval Energi AS. Both companies have had a 50% share in the licence. The initial drill-or-drop decision was 02.03.2020 for the licence. An extension of this decision date was applied for with a following approval for a new drill-or-drop decision set to 02.03.21. Due to marginal economics for the project the licence group wanted to further de-risk the project by incorporating nearby upcoming well results. A new drill-or-drop extension deadline was therefore applied for again. This was also approved by the authorities. To secure the full extent of the Vikafjell West prospect the licence group also applied for an area extension in the APA 2021 application round. This additional acreage (PL 927B) was awarded in 2022 (Fig. 1).


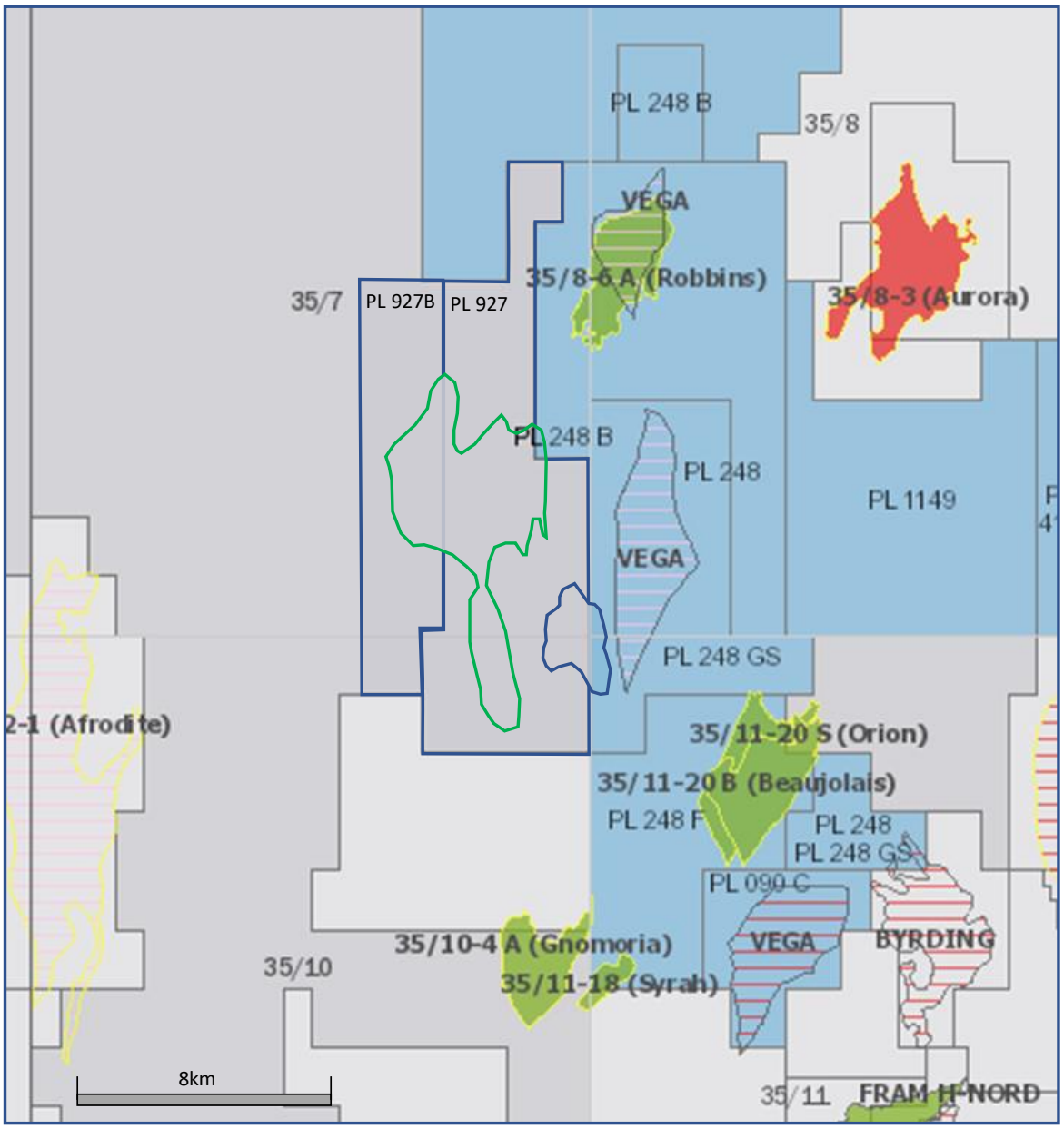


**Fig. 1 PL 927 and PL 927B Licence Overview**

*The Vikafjell West (green polygon) and Vikafjell East (blue polygon) prospects are located in PL 927 and PL 927B. The Vega Central field is located just east of these prospects.*

The initial work program for PL 927 was to reprocess seismic 3D data and perform G&G studies with a following drill-or-drop decision 01.09.2022. This same work program also applied to the additional acreage in PL 927B. A number of studies have been completed which fulfil the work program for the licences.

Main prospects for the licence have been the Upper Jurassic Vikafjell East and Vikafjell West, both characterised as structural-stratigraphic traps. Although gaining an improved understanding of the Upper Jurassic turbidite system the resource potential remains marginal and the irreducible risk elements are too high for a drill recommendation. Trap sizes are small and uncertain as the net-to-gross is highly variable in this Upper Jurassic system. Trap risk is high due to no direct hydrocarbon indicator or seismic attributes suggesting a working trap. As such the stratigraphic trap component cannot be confirmed in seismic data. Reservoir risk is also high due to deep burial and lack of analogue working reservoirs in the area.

# 1 History of the production license

**Table 1.1 PL927 Milestone overview**

| Licence | PL 927 & PL 927B |
|---|---|
| Awarded | 02.03.2018 (APA 2017), Licence Area Extension APA 2021 (PL 927B) |
| Licence blocks | 35/7 & 35/10 |
| Licence drill-or-drop extensions | 02.03.2020 (initial) to 02.03.21 (new)<br>02.03.21 (initial) to 02.03.22 (new)<br>02.03.22 (initial) to 01.09.22 (after APA application award of PL 927B) |
| Licence period | Expire 01.09.2022 (DOD 01.09.2022) |
| Licence group | Wintershall Dea Norge AS 50% (Operator)<br>Sval Energi AS 50% |
| Licence area | 65 km2 |
| Work program | Study of geology and geophysics, Reprocessing of 3D seismic |
| Meetings held | 09-05-2018 EC/MC startup meeting<br>29-11-2018 EC/MC meeting<br>18-10-2019 EC meeting<br>27-11-2020 EC/MC meeting<br>30-11-2021 EC/MC meeting<br>21-06-2022 EC/MC meeting |
| Work performed | 1. Seismic & rock physics modelling.<br>2. Absolute elastic inversion outputting Acoustic impedance and Vp/Vs for lithofacies and fluid discrimination.<br>3. Biostratigraphic sampling and review of all wells in the area which drilled the Upper Jurassic for accurately dating the sequence (Ichron).<br>4. Sedimentological review based on updated core description by Ichron.<br>5. Reservoir depositional facies map.<br>6. Generation of seismic facies maps to improve the understanding of the correlation of seismic amplitude and reservoir presence/reservoir quality.<br>7. Seismic conditioning and updated seismic inversion (2021), missed pay analysis utilising Earth Science Analysis machine learning techniques<br>8. Update prospect in-place volumes with new input from production well (35/8-Q-11 H) reservoir parameters. |
| Reasons for drop | Limited size: Trap size are small and uncertain as the net to gross is highly variable in the upper Jurassic system.<br>High trap risk: No direct hydrocarbon indicator or seismic attributes suggest a working trap. These stratigraphic trap component cannot be confirmed by seismic data.<br>High reservoir risk: The deep burial and the lack of analogue working reservoirs in the area still give a high reservoir risk. |

# 2 Database overviews

## 2.1 Seismic database

The seismic database for PL927 and PL927B is listed in Table 2.1 and shown in Fig. 2.1. The CGG17M01 3D seismic dataset was acquired in 2017 with a following reprocessing in 2018. CGG17M01WINR18-Q was reprocessed in 2021 (CGG17M01WDR21) and followed by a seismic inversion using this seismic dataset. With the reprocessing done in 2021 the image quality was significantly improved, making it appropriate to revisit the original seismic mapping and previous conducted seismic amplitude work.

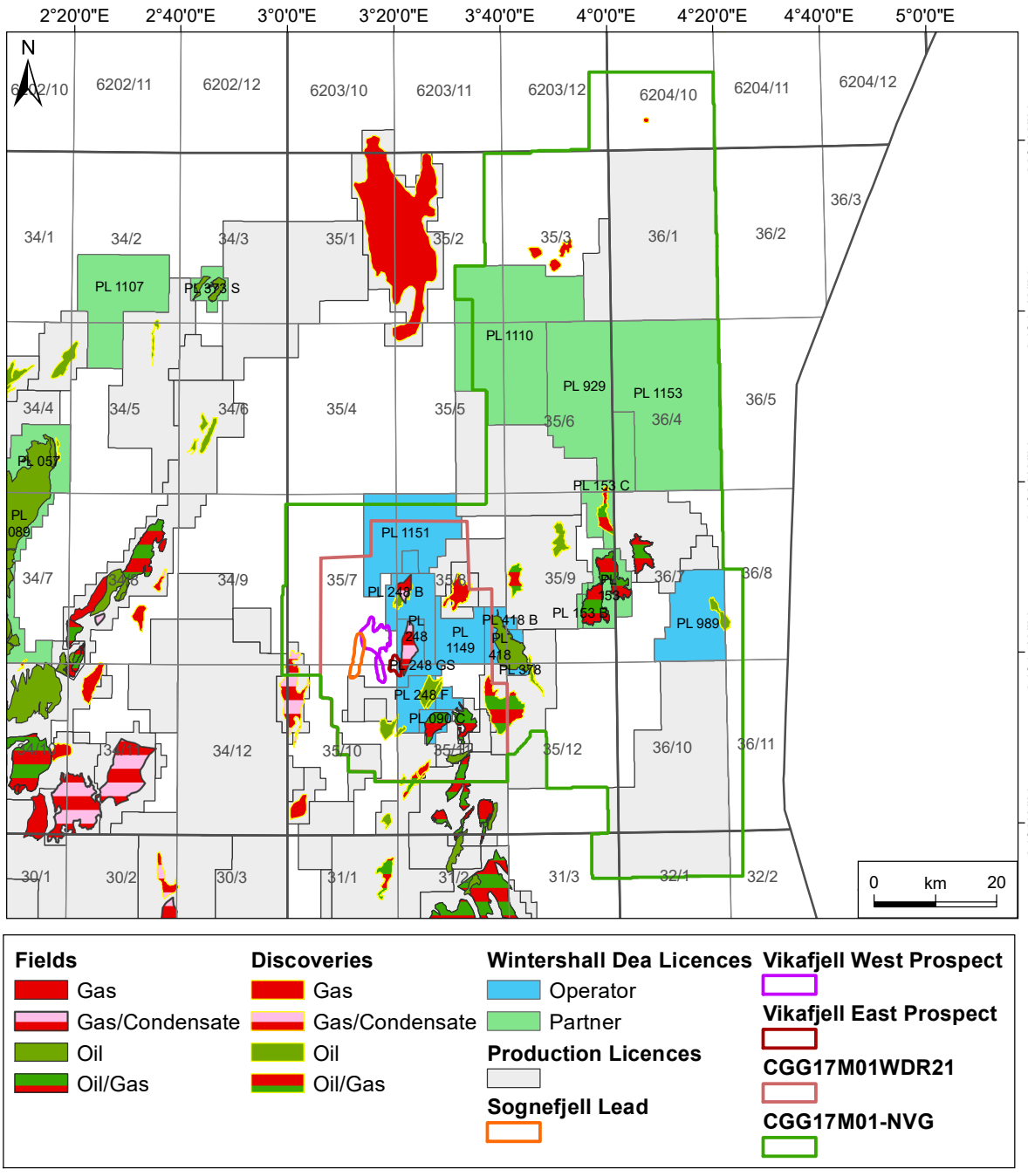


**Fig. 2.1 Seismic Database**

**Table 2.1 Seismic Database**

| Survey | NPDID | Volumes | Domain | Year | Quality |
|---|---|---|---|---|---|
| CGG17M01 | 8128 | Near-Mid-Far-Full Stack | 3D Time | 2017 | Fair |
| CGG17M01WINR18-Q | | Near-Mid-Far-Full Stack | 3D Time | 2018 | Fair |
| CGG17M01WDR21 | | Near-Mid-Far-Full Stack | 3D Time | 2021 | Good |
| CGG17M01WDR21 | | Inversion Cube | 3D Time | 2021 | - |

## 2.2 Well database

The well database for PL927 and PL927B is listed in Table 2.2 and shown in Fig. 2.2.

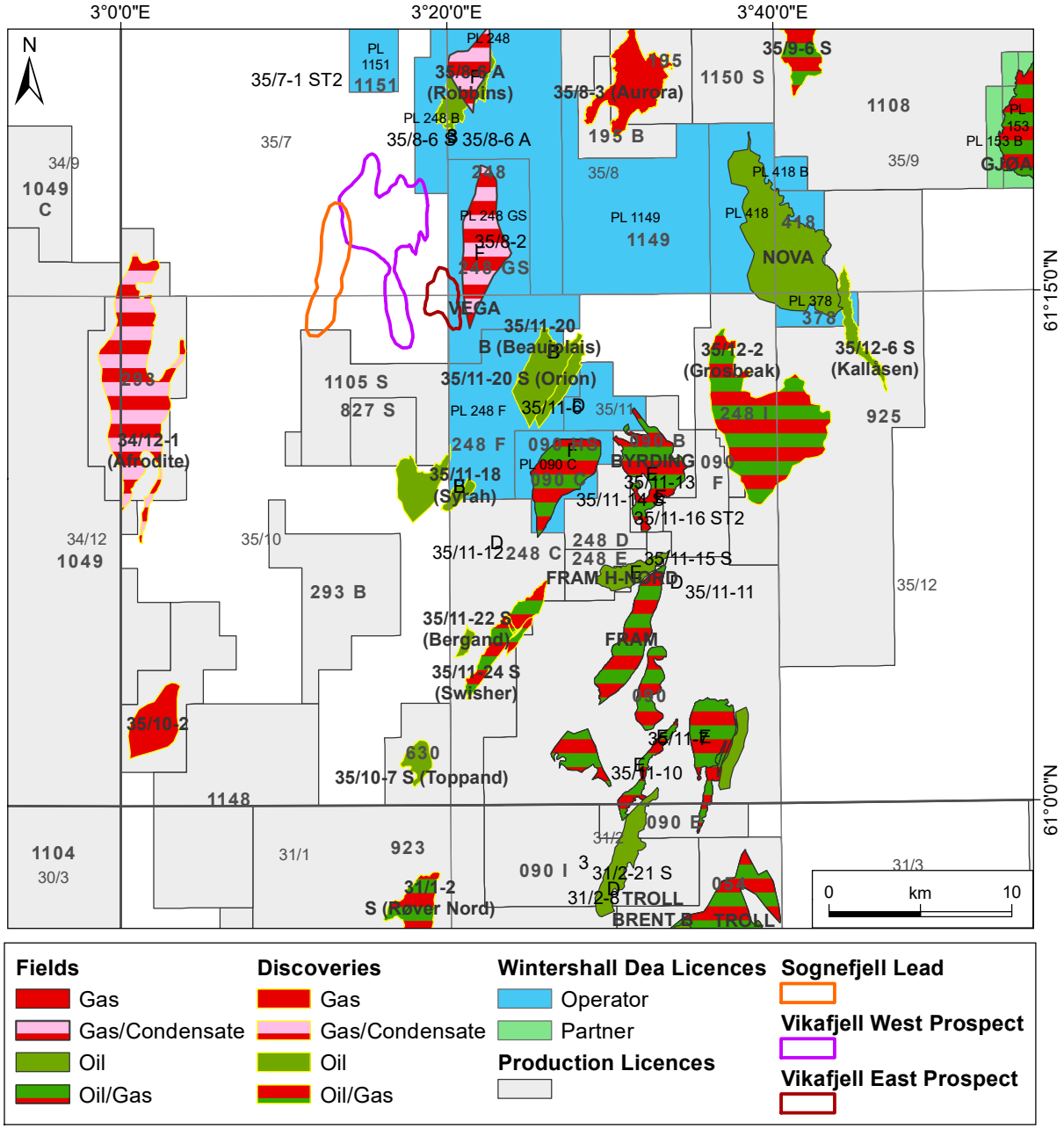


**Fig. 2.2 Well Database**

Wells in the database was used for seismic well-ties, seismic inversion, petrophysical input in volume calculation and a number of other studies conducted in the licence.

**Table 2.2 Well Database**

| Well | Year | TD Age | Field/ Discovery/ Result |
|---|---|---|---|
| 31/2-8 | 1982 | Early Jurassic | Dry |
| 31/2-21S | 2014 | Early Jurassic | Dry |
| 35/7-1 ST2 | 2011 | Early Jurassic | Dry |
| 38/8-1 | 1981 | Late Triassic | Vega Nord |
| 35/8-6A | 2016 | Late Jurassic | Robbins |
| 35/8-6S | 2016 | Late Jurassic | Dry |
| 35/8-2 | 1982 | Early Jurassic | Vega Sentral |
| 35/8-Q-11 H | 2021 | Middle Jurassic | Vega Sentral |
| 35/11-20A | 2016 | Middle Jurassic | Orion |
| 35/11-20B | 2016 | Middle Jurassic | Orion |
| 35/11-20B | 2016 | Early Jurassic | Beaujolais |
| 35/11-6 | 1992 | Early Jurassic | Vega Sør |
| 35/11-2 | 1987 | Early Jurassic | Vega Sør |
| 35/11-4 | 1990 | Early Jurassic | Fram |
| 35/11-7 | 1992 | Early Jurassic | Fram |
| 35/11-10 | 1997 | Early Jurassic | Fram |
| 35/11-11 | 1998 | Middle Jurassic | Shows |
| 35/11-13 | 2005 | Middle Jurassic | Byrding |
| 35/11-14S | 2006 | Late Jurassic | Byrding |
| 35/11-15S | 2007 | Late Jurassic | Fram H-Nord |
| 35/11-15ST5 | 2007 | Late Jurassic | Fram H-Nord |
| 35/11-16ST2 | 2014 | Late Jurassic | Dry |
| 35/11-12 | 2000 | Middle Jurassic | Dry |
| 35/11-18 | 2015 | Early Jurassic | Syrah |
| 35/11-18A | 2015 | Early Jurassic | Syrah |

## 3 Results of geological and geophysical studies

Two main prospects, Vikafjell East and Vikafjell West, have been identified within the PL 927 and PL 927B area. In addition to this a lead called Sognefjell was mapped. The prospects and lead reservoir consist of turbidite sandstones of Upper Jurassic / Late Oxfordian to Early Kimmeridgian age deposited at the outlet of Oxfordian Kimmeridgian canyons. Seismic reprocessing and seismic inversion along with G&G studies was performed to better understand this highly variable turbidite system in relation to observed seismic amplitudes. From seismic reprocessing the imaging improved significantly, but still it remains a challenge to fully understand what the observed seismic amplitudes represent given very few data points available for correlation.

Geophysical work conclude that in the elastic space there is a large degree of overlap between reservoir and non-reservoir facies (over- and underburden). This leads to high uncertainty for seismic based lithology definition i.e. to understand what the seismic amplitudes seen in the prospects actually represent.

The licence group has also utilised machine learning models to predict saturation for the potential reservoir. The building of a saturation model is an ongoing iterative process that will continue to improve with more model inputs. As of now the model show some positive indications, but it is still too early to be used for a drill-or-drop decision.

The prospects in PL 927 and PL 927B was initially defined based on seismic amplitudes. However, geophysical work show that there are too many unknowns for these prospects for the time being. The licence group therefore agreed for a drop decision for the licences.

**Work performed in the licence**

- Seismic and rock physics modelling
- Absolute elastic inversion outputting acoustic impedance and Vp/Vs for lithofacies and discrimination
- Biostratigraphic sampling and review of all wells in the area which drilled the Upper Jurassic section for accurately dating the sequence (Ichron)
- Sedimentological review based on updated core description by Ichron
- Reservoir depositional facies map
- Generation of seismic facies maps to improve the understanding of the correlation of seismic amplitude and reservoir presence / reservoir quality
- Seismic conditioning and updated seismic inversion (2021)
- Missed pay analysis utilising Earth Science Analytics machine learning techniques
- Update prospect in-place volumes with new input from production well reservoir parameters

# 4 Prospect update report

Due to few data points available for seismic amplitude correlation in the prospect area, we can not use seismic amplitudes as a direct indicator for reservoir presence. We therefore use the structural / stratigraphic closure to define the trap and its trap fill.

### Vikafjell East Summary

The Vikafjell East prospect is a structural / stratigraphic trap. It is fault bounded to the east and truncated by the BCU / VU to the south. To the North the prospect is defined by a structural spill. Key risks are trap effectiveness (lateral seal) and reservoir effectiveness (cementation). The crest for the prospect is at 3350m TVDSS (Fig. 4.1).

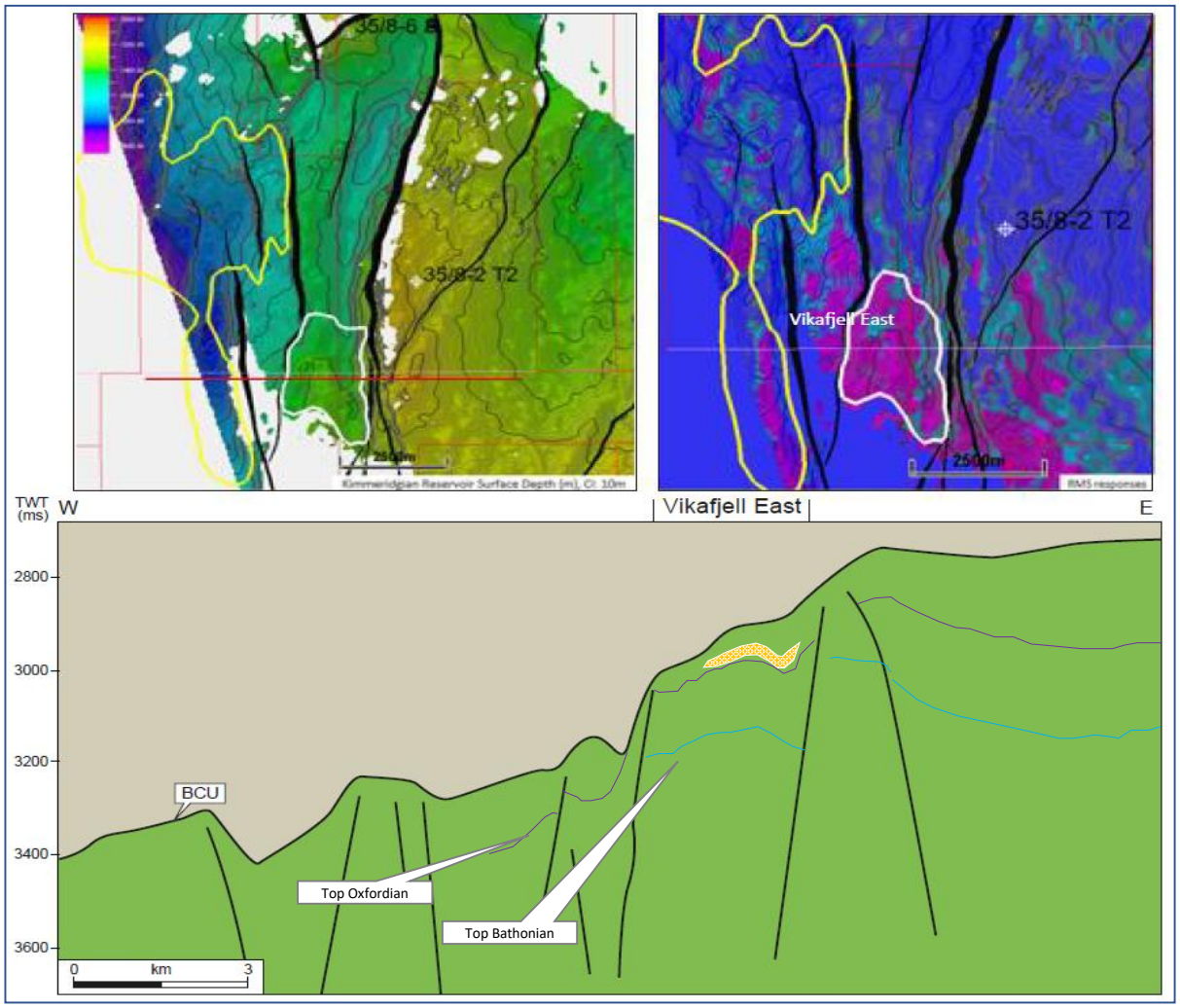


**Fig. 4.1 Vikafjell East**

*The Vikafjell East prospect is defined by a structural closure. A seismic amplitude anomaly is also present within this closure. Due to lack of missing correlation data points using the amplitude anomaly as a proxy for reservoir sands is challenging. The Vikafjell East prospect was therefore defined based on the structural closure.*

- **Reservoir**: Late Oxfordian / Early Kimmeridgian turbidite sandstones
- **Seal**: Kimmeridgian Heather and Draupne shales
- **Source Rock**: Kimmeridgian Heather and Draupne shales
- **Hydrocarbon Type**: gas condensate
- **Mean Recoverable Resources**: 3.06 mmboe

**Table 4.1 Resource Potential Vikafjell East**

| | Mean | P90 | P50 | P10 | POSg (%) |
|---|---|---|---|---|---|
| Inplace Resources (STB OE) | 5.45 | 0.44 | 3.82 | 12.8 | 31.5 |
| Recoverable Resources (STB OE) | 3.06 | 0.24 | 2.11 | 7.21 | |

## Vikafjell West Summary

The Vikafjell West prospect is located on a down-faulted block relative to Vikafjell East. The prospect was defined by a pinch out of a seismic amplitude interpreted as top of the reservoir in the south, north and west. The key risks are trap effectiveness represented by lateral seal, and reservoir effectiveness represented by cementation. Crest for the prospect is at 3546m TVDSS (Fig. 4.2).

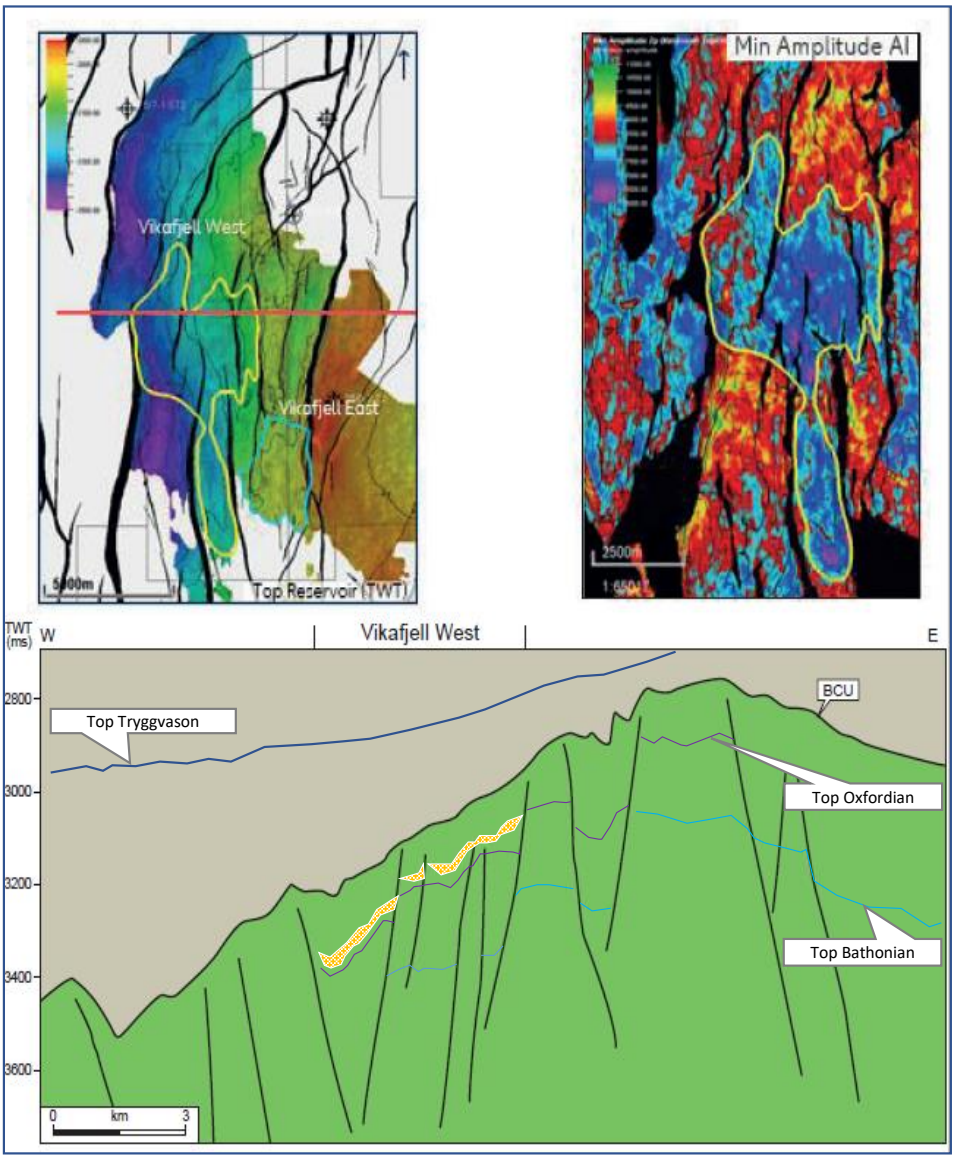


**Fig. 4.2 Vikafjell West**

*Vikafjell West is a prospect that was defined by pinch-out of a seismic amplitude. Due to few correlation data points it is challenging to use the seismic response as a proxy for reservoir sands. For the Vikafjell East evaluation a structural closure is present and therefore represent the prospect trap. Due to the challenge regarding seismic amplitude and what it represents we need to follow the same methodology for both prospects. Therefore, Vikafjell West will no longer be regarded as a prospect.*

- **Reservoir**: Late Oxfordian / Early Kimmeridgian turbidite sandstones
- **Seal**: Kimmeridgian Heather Shales
- **Source**: Kimmeridgian Heather Shales
- **Hydrocarbon Type**: Gas Condensate
- **Mean Recoverable Resources**: -

As described earlier, seismic amplitudes as proxy for reservoir presence is unclear. The Vikafjell West prospect was originally defined by its seismic amplitude response, but due to the uncertainty it is now challenging to define the prospect based on seismic amplitudes alone. There is no structural closure present and therefore the prospect will, as of now, have no mean recoverable resources.

## 5 Technical assessment

Based on additional G&G- and geophysical work the prospects and volumetric assessment has been updated. Remaining risk is significant, and the Operator do not see further potential for de-risking at this point. Seismic amplitude anomalies observed is still not possible to use as a proxy for reservoir sand presence. Therefore, the relatively low and uncertain volume potential together with significant risk result in negative economic potential. The partnership of PL 927 and PL 927B therefore decided to drop the licence.

## 6 Conclusion

In the view of the partnership, the opportunities identified in licence PL 927 and PL 927B do not present drillable targets based on our current technical understanding, and the significant risks of finding an economic accumulation of hydrocarbons.